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ABSTRACT

To assess the instructional effectiveness and user acceptance of a computer-controlled videodisc program designed to teach medical students to recognize and assess motor dysfunction in infants, an experimental group of third year medical students (N=65) were instructed using the videodisc program; a corresponding control group (N=70) did not use the program. Data were gathered from three instruments: (1) a 10-item multiple choice subtest on knowledge that was embedded in the 120-item final examination at the end of the 6-week pediatric rotation; (2) a 9-item multiple choice subtest assessing diagnostic skills that was provided via videotape as part of the same exam; and (3) a 20-item attitude questionnaire for students in the experimental group. Findings indicate that there were statistically significant differences between the experimental and control groups and that the students in the experimental group scored higher on both subtests. Neither variation on the amount of prior clinical experience nor time spent in the clinical unit had an effect on student scores. In addition, despite some technical problems, students' evaluation of the program's educational qualities was very positive and all said the program should continue to be part of medical school training in pediatrics. However, medical students did rate computer-videodisc second behind actual experience as an instructional method. Information on subsequent updating of the program, sample computer screen and videodisc frames from the program, a list of references, four data tables, and examples from the 19-item diagnostic test complete the document. (JB)

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EVALUATION OF A COMPUTER-CONTROLLED VIDEODISC PROGRAM TO TEACH PEDIATRIC NEUROMOTOR ASSESSMENT

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EVALUATION OF A COMPUTER CONTROLLED VIDEODISC PROGRAM THAT TEACHES PEDIATRIC NEUROMOTOR ASSESSMENT

OBJECTIVES

The **objectives*** of this study were to **assess** the **instructional effectiveness** and **user acceptance** of a computer-controlled videodisc program teaching medical students to recognize and assess motor dysfunction in infants.

PERSPECTIVES

In the U.S. six thousand infants are born annually with cerebral palsy; many more have other neuromuscular handicaps. Because such neurological defects are often first detectable through faulty motor development, professionals providing health care for infants and children need to finely discriminate between movements signifying normalcy or disability. These skills are usually taught while caring for patients, yet **seldom** are there enough **infants available** during training to demonstrate a sufficient variety of disabilities.

*Throughout the article, we highlight key phrases in bold face to assist in skimming the information.

The lack of an adequate patient base for teaching third year medical students to recognize developmental disabilities was the primary impetus for the development of the program evaluated in this study. Junior medical students rotate through 12 required clerkships across specialities such as surgery and obstetrics. While on the six week long Pediatric clerkship, some students spent 2-3 days in the Developmental Disabilities Clinic. The quality of the experience in the clinic was determined in large part by the number and variety of patients that were present. Typically, students saw one patient per day in the clinic. This is an inadequate number of patients to represent the variety of neuromuscular dysfunctions that physicians should recognize.

In order to teach pediatric neuromotor assessment, but faced with an inadequate patient population, alternative approaches were needed. Originally, one of the authors, Dr. James Blackman, developed a slide-tape program to address the need. Unfortunately, this slide-tape program could not show motion - a critical element in depicting normal and abnormal movements. After careful consideration, an interactive videodisc format was chosen to present the material. There were several reasons for this choice. Because of the heavy scheduling of student time in clinics and the potential for unexpected periods where no patients were present, we considered it important for the materials to be self-paced. Also, from an educational viewpoint, we wanted students to be active learners and therefore required periodic questioning with feedback. For these reasons, the

interactive videodisc program entitled "Assessment of Neuromotor Dysfunction in Infants" was developed jointly by members of the College of Medicine, University Hospital School, and Weeg Computing Center. Thus, the developmental effort was driven by a problem, not by a technology. This evaluation was conducted in order to determine if the videodisc program provided an improved learning experience over simply letting students learn through patient cases and to decide if the program should be regularly incorporated as part of the curriculum.

THE INSTRUCTIONAL PROGRAM

The instructional program consisted of a mini-course, primarily for third year medical students, delivered via a computer controlled videodisc. This technology has been widely acclaimed for instruction and is rapidly maturing from an isolated prototype to a standard delivery choice (Johnson 1984).

The program begins with an explanation of how to use the 2-screen system (one screen for the videodisc, the second for the computer), and then provides an optional introduction that describes basic **sources of information** (history, physical, parental comments). The central focus is on pediatric neuromotor assessment. The **five components in the assessment** - muscle function, movement, reflexes, structure, and gross motor skills - are each covered in a separete

section. Finally, a **case study** presents a patient not previously shown, to elicit diagnostic decisions (see Figure 1).

In considering any program evaiuation, it is useful to be familiar with the program being evaluated. While there is no substitute for completing the 3-5 hour course, the displays on the following pages should help to provide a better sense of how the program operates.

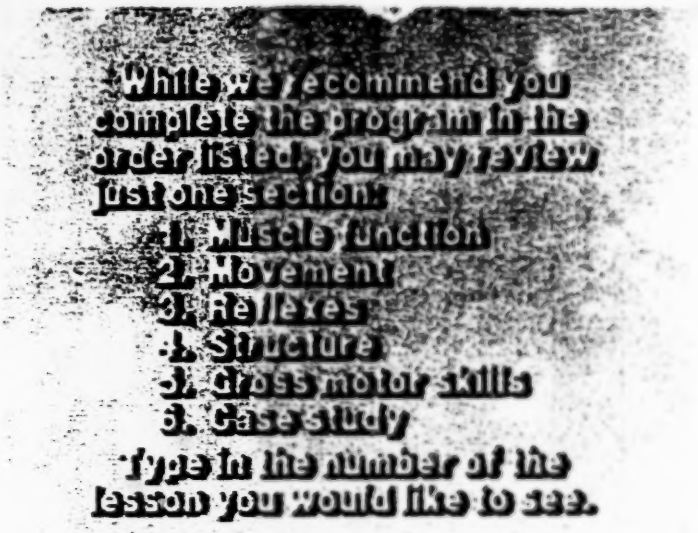

Figure 1: Videodisc Display of Program's Main Section

Motion segments documenting neuromotor exams of 27 patients are shown via the videodisc. The videodisc also displays static text in still frames (see Figure 2).

Figure 2: Videodisc Still Frame Example

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The second audio track allowed us to use the same motion segment with different narration when the motion illustrated multiple concepts. The second audio track was also used to describe computer-generated graphics (see Figure 3).

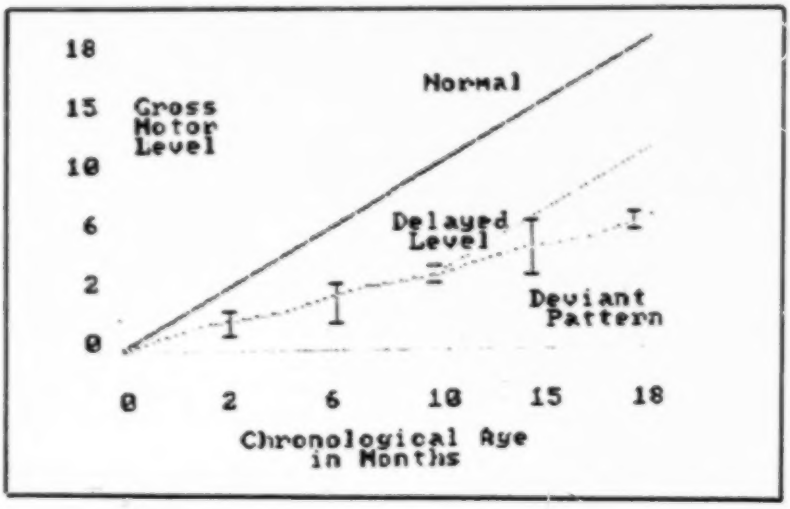

Figure 3: Computer Generated Graphic Used With Track 2 Audio

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Computer generated graphics also highlight essential characteristics of a neuromotor attribute before a patient with that dysfunction is shown via the videodisc (see Figures 4 and 5).

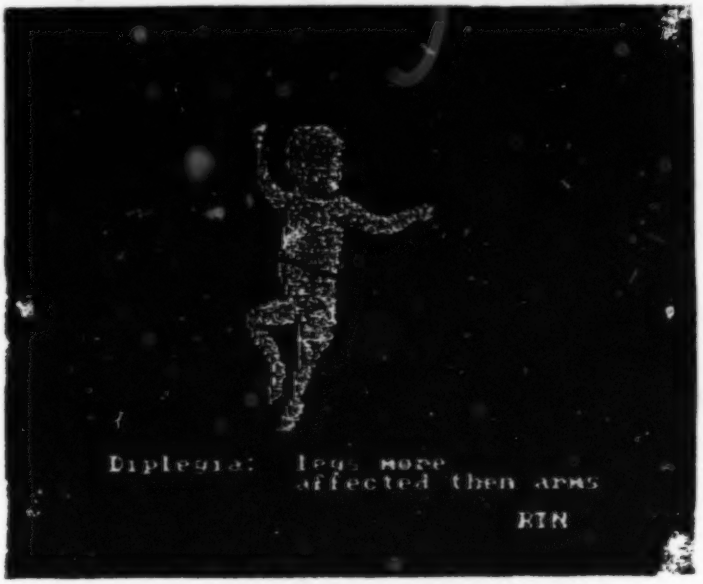

Figure 4: Computer Graphic of Diplegia Used Prior to Motion Example

Figure 5: One Frame From the Motion Segment Depicting Diplegia

The computer program allows the user to select topics of interest, which are highlighted when completed (see Figure 6).

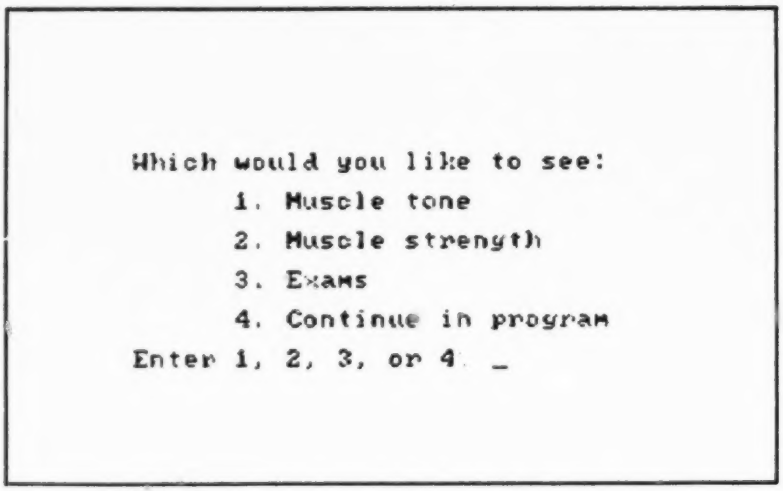

Figure 6: Sample Computer Menu

The computer program also provides options that are always available via designated function keys (see Figure 7). The ability to immediately repeat motion segments is particularly useful in a teaching program on neuromotor dysfunction.

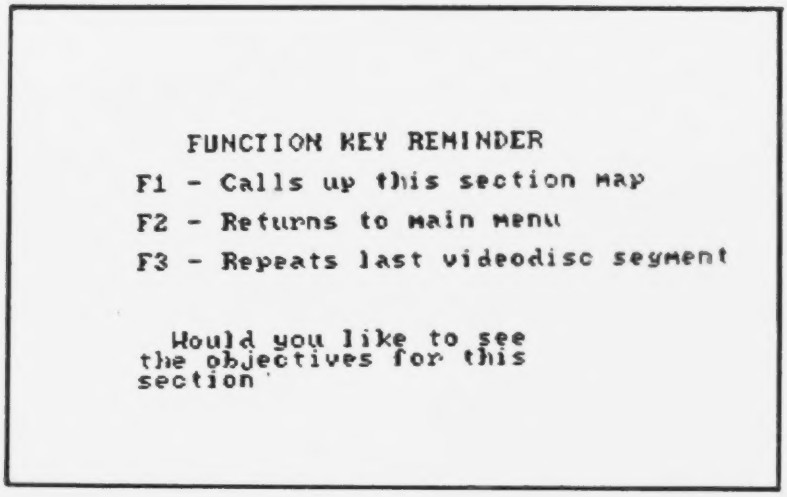
FUNCTION KEY REMINDER
F1 - Calls up this section map
F2 - Returns to main menu
F3 - Repeats last videodisc segment
Would you like to see the objectives for this section

Figure 7: Function Key Options That Are Universally Available

Over 180 questions are embedded in the program and presented via the computer; many have a video component. When the computer presents objective items, color - which appears in figure 8 as lighter text - highlights and reinforces correct answers.

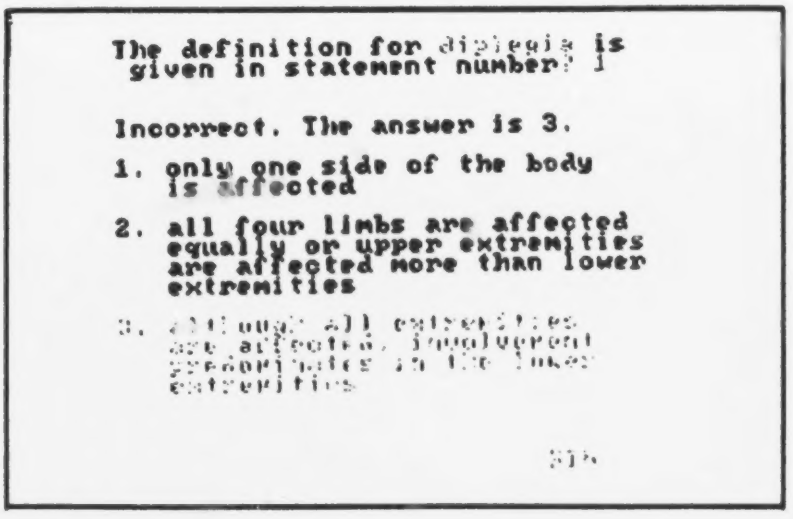
The definition for diplegia is
given in statement number? 1
Incorrect. The answer is 3.
1. only one side of the body
is affected
2. all four limbs are affected
equally or upper extremities
are affected more than lower
extremities
3. although all extremities
are affected, involvement
predominates in the lower
extremities

Figure 8: Sample Test Item Showing Use of Color to Highlight Correct Answer

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Both the **computer** and **videodisc** components are essential. To provide a flavor of how they are **integrated**, Figures 9-14 show segments of text and video from the program.

Screen 1 - Videodisc

Single frame from a motion segment used for testing

Screen 2 - Computer

```
Does this child appear
to be a hemiplegic?

Press F3 to repeat the segment.
Please enter Yes or No  _
```

Question, optional repeat on computer

```
Does this child appear
to be a hemiplegic?

Incorrect.
Notice the fisting and flexed
posturing on the baby's right
extremity compared to normal
movement on the left. Difference
in the tone of the lower
extremities is less obvious.
```

Feedback on computer

Figure 9: Sample In-program Test Item from Muscle Function

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Screen 1 - Videodisc

Screen 2 - Computer

The next child is also
2 months old.

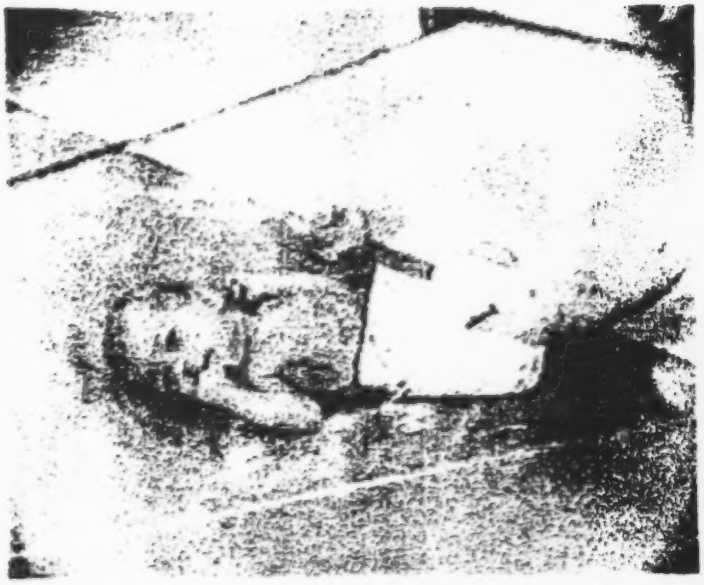
Evaluate his gross motor skills

View each item.

Answer yes if the infant
performs the activity.

Answer no if the activity is
not performed.

To repeat the segment, press F3.



Instructions on completing
the simulation

Gesell Gross Motor: 8 weeks (2 months)

1. Supine: head mid position seen
2. Supine: symmetric postures seen
3. + Sit: head bobbingly erect
4. + Ventral suspension: head compensates
5. Prone: head to 45 degrees recurrently
6. Prone: hips low, frog position

Enter Yes, No, or R to repeat

Single frame from motion
example - six different samples
would be shown in the sequence

Sample user entry

Figure 10: Sample from Simulation of Gesell
Gross Motor Assessment

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Screen 2 - Computer

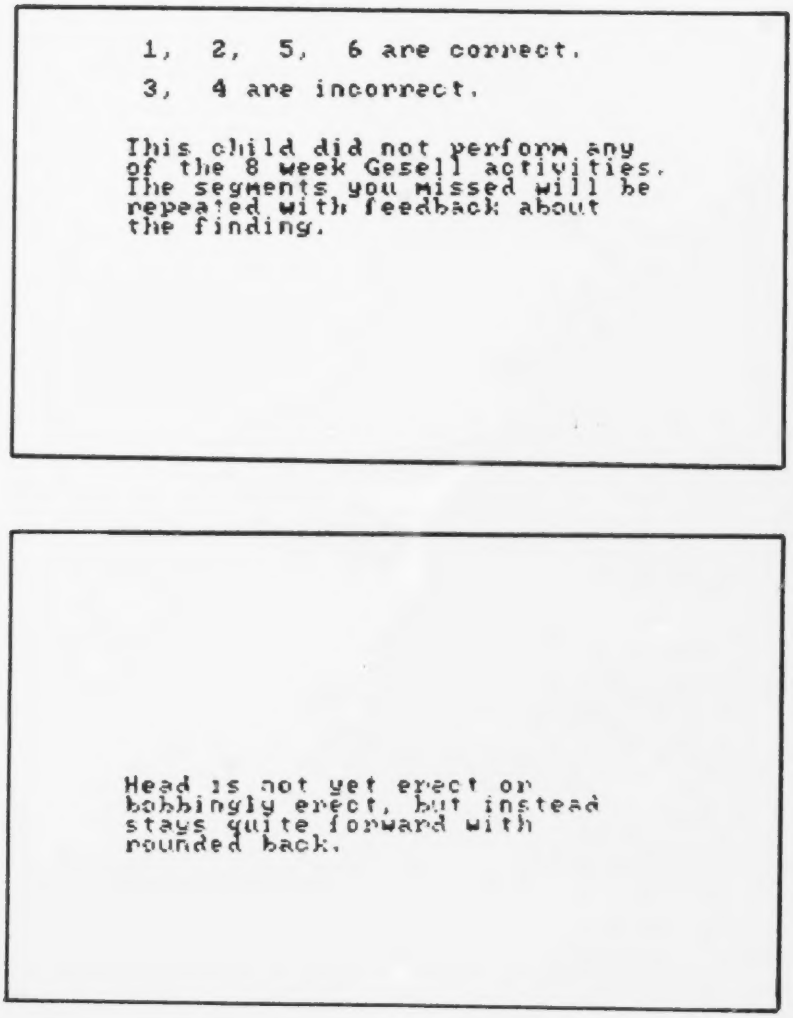
1, 2, 5, 6 are correct.
3, 4 are incorrect.
This child did not perform any of the 8 week Gesell activities. The segments you missed will be repeated with feedback about the finding.
Head is not yet erect or bobbingly erect, but instead stays quite forward with rounded back.

Figure 11: Sample Follow-up Computer Displays. Appropriate Video Sequences are Repeated with Feedback.

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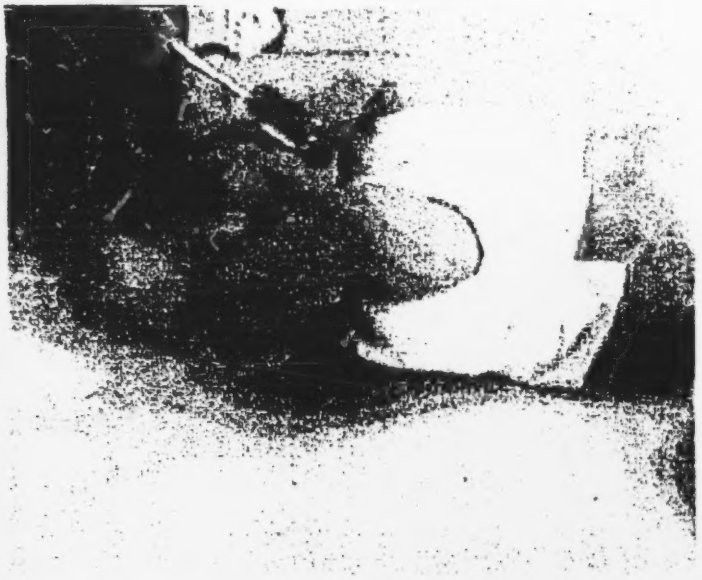
Screen 1 - Videodisc



Sample frame from videodisc motion

Screen 2 - Computer

```
The deep tendon reflex
shown in this segment is:

     1.  normal
     2.  weak
     3.  brisk

Press F3 to repeat.

Please enter 1, 2, or 3  _
```

Question presented on computer

```
The deep tendon reflex
shown in this segment is:

     2.  weak
     3.  brisk

Correct.
The patellar reflex is often
the easiest to obtain and may
seem a bit brisk compared
to other responses.

Press F3 to repeat or press
RTN to continue
```

Feedback on computer

Figure 12: Sample Test Item from Reflexes

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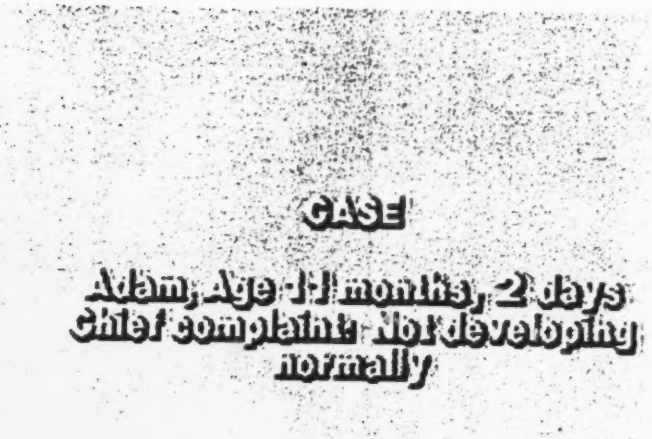
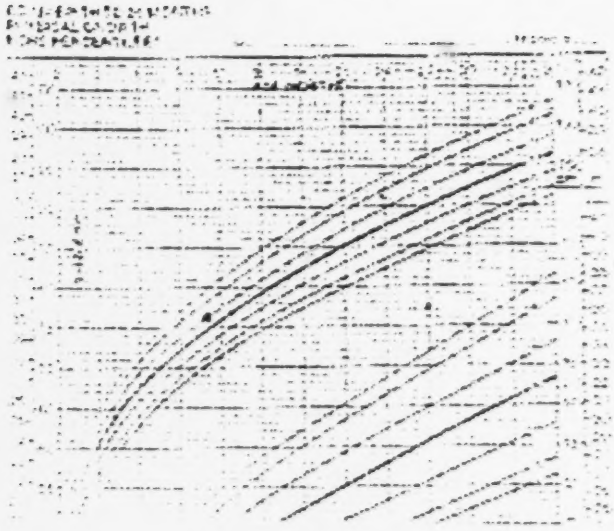
Screen 1 - Videodisc





Videodisc still from physical

Screen 2 - Computer

```
Which parameter of motor
assessment would you like to see _
  1. Muscle function
  2. Reflexes
  3. Movement
  4. Structure
  5. Gross motor skills
  6. return to history and physical
  7. continue with interpretations
```

Computer menu for Case Study

Figure 13: Sample Displays from Case Study

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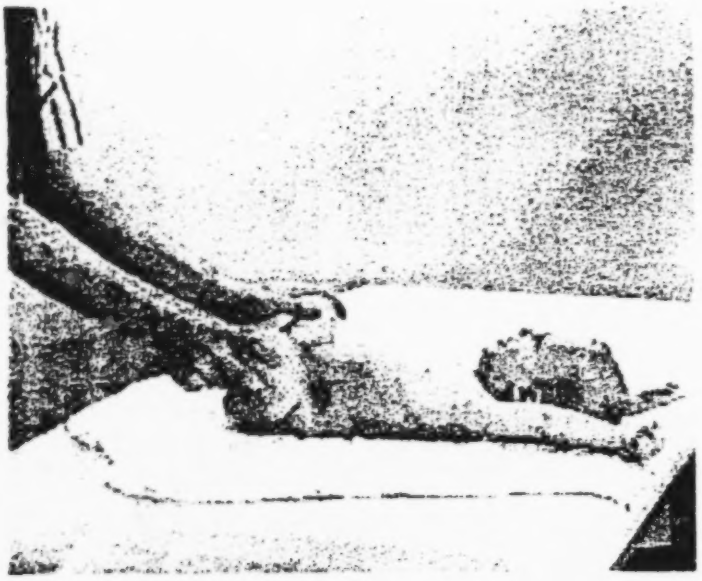
Screen 1 - Videodisc

Screen 2 - Computer



QUICK MUSCLE STRETCH

Do you see a 'catch' followed by release, i.e. the clasp-knife phenomenon

To repeat segment, press F3.

Sample frame from videodisc motion segment

Question Corresponding to videodisc segment

Figure 14: Sample from Case Study

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21

22

Figure 15: A User at the 2-screen Station

EVALUATION QUESTIONS

Having invested over a year in developing the program, we wanted to objectively determine its effectiveness. We sought to answer the following questions:

1. Did junior medical students who completed the program learn more than students who did not?

2. Would variation in amount of prior clinical experience (regardless of medical specialty) cause students to profit differentially from the program?

3. Would variation in time spent in the Developmental Disabilities Clinic (a clinic specializing in assessing and teaching developmental disabilities) cause students to learn differentially from the program?

4. For instruction using interactive, video-based technology, how effective would both verbal and visual modes of testing be?

5. How valuable and easy to use did students perceive the instructional materials to be?

POPULATION

Eight different groups of third year medical students complete the Pediatric clerkship throughout a calendar year. Between March 1983 and February 1984, these eight groups were alternately

designated as either "Experimental" or "Control" for this evaluation. Experimental groups (n=65) worked through the videodisc program that taught fundamentals of a diagnosing developmental disabilities in infants. Students were given access to the videodisc station in two 2-hour blocks. They could - and many did - use the program beyond this 4 hour period when it was not being used by other students. The control groups (n=70) did not work through the videodisc program. To avoid treatment contamination, all students enrolled during a given six-week clerkship received the same treatment which alternated with each clerkship. All students attended two lectures on normal and abnormal child development. Some students, regardless of group, spent 1-3 days in the developmental disabilities clinic.

There are two features of the medical curriculum which were thought to have a potential influence on the instructional effectiveness of the videodisc program. First, the prior clinical experience varied for different groups of students. Students who participated in the study later in the academic year had more clinical experience than those who participated earlier. Second, the amount of time students spent in the Disabilities Clinic, where diagnosis of developmental disabilities was emphasized, varied from zero to three days.

DATA SOURCES

Data were gathered from three instruments:

Instrument 1 - All students completed a 10-item multiple choice subtest embedded in the 120-item final examination at the end of the six-week Pediatric rotation. This 10-item subtest was text based and assessed Knowledge (see Appendix A).

Instrument 2 - All students also completed a 9-item, multiple choice subtest with stimulus material provided via videotape as part of the same exam. This exam assessed diagnostic skills (see Appendix A).

Instrument 3 - The third instrument consisted of a 20-item attitude questionnaire which students in the Experimental group completed as they finished the videodisc program (see Table 4).

The 19 items from Instruments 1 and 2 were distributed across the five content areas as follows: muscle function-3, reflexes-6, movement-3, structure-3, gross motor skills-4. The items were constructed by one of the authors, Dr. Blackman.

STATISTICAL ANALYSES

Two sets of two-factor analyses of covariance were computed to answer questions 1-3. Scores on the non-experimental version of the final exam served as a covariate to adjust for possible pre-existing differences among groups. The primary factor of interest in both analyses was treatment with two levels (experimental and control). The second factor differed in the two sets of analyses as follows.

In the first analysis, **prior clinical experience** was entered as the **second factor**. Since the amount of the students' prior clinical experience varied from group to group, it was thought to be a potentially confounding variable. (Students assigned to pediatrics in the first clerkship of the year had no prior clinical experience, those assigned in the second had six weeks of prior experience in other specialties, those in the third had 12 weeks of prior experience, and so on.) The prior clinical experience factor had four levels, which were derived in the following manner. The first pair of clerkships was the first level (recall that the treatment received by consecutive groups in their pediatrics rotation was alternated), the next pair were the second level, and so on.

In the **second analysis**, the **number of days** in the Division of Developmental Disabilities (DDD) at The University of Iowa was the second factor. The DDD experience had a greater emphasis on the diagnosis of development disabilities than did the other pediatric services in which students participated. This factor had **four levels** corresponding to the number of days a student spent in the DDD, and ranged from zero to three.

For question 4, we inspected the reliability of the written knowledge and video diagnostic subtests. Finally, we calculated **percentages** of students selecting each option on the **questionnaire** to assess Question 5.

RESULTS/CONCLUSIONS

Tables 1-4 in the Appendix present the complete statistical analysis. The summarized results are:

Q1 - Did junior medical students who completed the program learn more than students who did not?

Finding: These were **statistically significant** differences between the experimental and control groups on both the written ($p<.0003$) and video ($p<.0001$) subtests (see Table 1). The students in the **experimental** group **scored higher** on both subtests.

Conclusion: Junior medical students who completed the program learned more than students who did not, attesting to the program's effectiveness.

Q2 - Would **variation** in amount of prior **clinical experience** (regardless of medical specialty) cause students to profit differentially from the program?

Finding: As shown in Table 1, the amount of **prior clinical experience** was statistically **significant** ($p<.02$) for the **written test only.** However, the patterns of scores across groups was notably **erratic.** Either the statistical significance was a chance result of sampling or there was a nonlinear relationship between students' prior clinical experience and their scores on the test. Given that the video subtest results failed to indicate statistical significance for the experience

factor, it seems reasonable to assume that the statistical significance of the written subtest was a chance result.

Conclusion: Variation on the amount of prior clinical experience did not cause students to profit differentially from the instructional program.

Q3 - Would variation in time spent in the Developmental Disabilities Clinic (a clinic specializing in assessing and teaching developmental disabilities) cause students to learn differentially from the program?

Finding: The number of days spent in the Division of Developmental Disabilities failed to produce statistically significant differences in test performances shown in Table 2.

Conclusion: Variation in the number of days spent in the Division of Developmental Disabilities did not cause students to profit differentially from the program.

Q4 - For instruction using interactive, video-based technology, how effective would both <u>verbal</u> and <u>visual</u> modes of <u>testing</u> be?

Finding: It is interesting to note that the reliability of the audio visual format test was substantially higher than the reliability of the written test (.41 vs. .18 respectively).

Discussion: Neither reliability estimate could be considered adequate for any purpose other than research (e.g. these tests would not be useful for assigning grades). Apparently the treatment effects were

sufficiently large that the poor reliability of the tests did not seriously diminish the significance of the statistical analyses.

Q5 - How valuable and easy to use did students perceive the instructional materials to be?

Finding: Responses on the technical aspects were mixed. Ninety-eight percent found the program easy to use; 97% could read the numerous video frames of text easily. Fifteen percent had some difficulty getting the program to work after the initial orientation. Sixty percent indicated that the program failed to work properly at some point (usually minor problems). About 70% felt that the program moved too slowly--a technical problem that will be discussed later. Though the entire program took about four hours to complete, students found on the average that one and one-half hours was as long a period as they could comfortably concentrate in this setting.

Despite some of the technical problems indicated, student evaluation of the program's educational qualities was very positive. Most felt that the material was well organized and easy to understand. They indicated that the system, particularly with the video examples of children's movement, aided their learning and improved their assessment skills. Eighty-eight percent viewed the integrated questions as useful. Most importantly, all said that the program should continue to be a part of medical student training in pediatrics. When comparing methods of instruction, medical students rated computer-videodisc

second behind actual experience and ahead of lectures and traditional reading materials.

Conclusion: Junior medical students perceived the instructional program as valuable and easy to use.

DISCUSSION

Although medical students were assigned to six-week clinical rotation in a quasi-random manner by the medical college, they were not randomly assigned to treatment and non-treatment groups for this study. Students within a block tend to stay with the same group throughout all clinical rotations and generally have less day-to-day interaction with students in other groups. It was felt that all students in a six-week block should either be exposed or not exposed to treatment, in order to avoid treatment contamination e.g. discussion of the program among students and to minimize Hawthorne effect (i.e., experimental students perceiving themselves to be a select group and responding to this by improving their performance independent of the program).

Another limitation was that the objective test measured cognitive skill rather than clinical performance skill. Although video items were used in order to simulate real world encounters more closely, it cannot be determined from this study how well the students were able to apply in the real world what they had learned in the computer-videodisc program. It was obviously impossible to present

the same patient, in the same physical state, for all 135 students in the study.

Another limitation is that on two of the nine items in the Video subtest (items 5, 7), the video augmented the question but was not an essential component. Video was used in these items to help project the student into the clinical situation. The reliability of the video subtest with these two items removed decreased from .41 to .36. Of course we view the reliabilities cautiously since the subtests were so short.

EPILOG

This study was conducted using a prototype version of the refined program which is use today. It was a prototype not only in terms of the computer program and videodisc, but also in the physical components used. No changes were made to the program during the study, nor were results scrutinized. However, many changes have been made since then to both the computer program (expanded feedback, changed confusing nomenclature, eliminated minor bugs) and to the videodisc (added better examples of video segments, added graphics). These changes were based on reviews by physicians and physical therapists from another major medical institution. Additionally, a new, commercially available interface is now used, one that makes transitions within the program virtually instantaneous.

The original interface, a prototype constructed at the University of Iowa for this study, was slow because it relied on BASIC subroutines. Originally, students experienced delays of approximately one second. Obviously, an interactive videotape system with delays many, many times greater, would have been totally unacceptable to students.

Is the program being used today?

Yes - by the following populations:

1. Third year medical students
   The amount of time spent in the Division of Developmental Disabilities has been cut to one day. Consequently, since the program takes 3-5 hours, students are not required to complete it. However, if there is no patient that day, or if the patient is late, students use the program.

2. Residents
   Pediatric residents on a one month rotation in the Division of Developmental Disabilities complete the program.

3. Pediatric Nurse Practitioners (PNP)
   PNP's receive continuing education credit as they complete the program. A majority of PNP's in Iowa have taken the program.

4. Practicing Pediatricians
   Many physicians who return to the University for a variety of reasons have completed the programs.

5. Physical Therapy Graduate Students

Students enrolled in "Therapeutic Exercise", a required course for all students pursuing a Certificate in Physical Therapy (currently 30 per year), must complete the program.

6. Physical Therapy Interns
   Physical therapy students completing 6-week clinical internships complete the program.

7. The program is now being commercially distributed by Williams and Wilkins Publishing Company. Within a year we should know how it is being used in other health science curricula.*

Currently, efforts are being made to incorporate the system into the general Pediatrics Clinic so that it can be used by more medical students.

This study is one of the first evaluations of an instructional videodisc program to be conducted as part of an ongoing curriculum. It also spans one of the longest assessment periods (one year). While not without limitations, this study offers promising results regarding the effectiveness of a particular instructional program designed to respond to a particular instructional need. This program cannot substitute for actual clinical experience, but it can augment the limited opportunities available to students.

Information regarding availability of the videodisc program can be obtained from:

Williams and Wilkins
428 East Preston Street
Baltimore, MD 21202
1-800-638-0672

Information regarding videodisc development at the Weeg Computing Center can be obtained from:

Dr. Joan Sustik Huntley
Research and Development Project Leader
Computer Assisted Instruction Laboratory 229LC
Weeg Computing Center
University of Iowa
Iowa City, Iowa 52242
(319)353-4357

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Table 1

Adjusted means and standard deviations of test scores for experimental (N=70) and control (N=65) students at each level of prior clinical experience

		Treatment							
		Written[1]				Video[2]			
Experience	N	Experimental		Control		Experimental		Control	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
0-12 weeks	36	7.78	(.30)	7.33	(.32)	8.10	(.29)	6.47	(.30)
12-24 weeks	35	7.51	(.31)	6.95	(.32)	7.89	(.29)	6.47	(.30)
24-36 weeks	32	8.62	(.32)	7.53	(.34)	7.56	(.30)	6.87	(.32)
36-48 weeks	32	7.78	(.33)	6.50	(.33)	7.56	(.31)	6.87	(.31)
TOTAL	135	7.92	(.16)	7.08	(.16)	7.92	(.15)	6.58	(.15)

[1] Treatment: F (dfb=1, dfe=126) = 13.76, $p < .0003$

Experience: F (dfb=3, dfe=126) = 3.33, $p < .02$

Treatment X Experience: F (dfb=3, dfe=126) = 0.78, $p < .51$

[2] Treatment: F (dfb=1, dfe=126) = 38.38, $p < .0001$

Experience: F (dfb=3, dfe=126) = 0.09, $p < .96$

Treatment X Experience: F (dfb=3, dfe=126) = 1.01, $p < .39$

Table 2

Adjusted means and standard deviations of test scores for experimental and control students by the number of days spent in Division of Developmental Disabilities (DDD).

Days at Div. Developmental Disabilities (DDD)	N	Treatment			
		1 Written		2 Video	
		Experimental	Control	Experimental	Control
		$\bar{X}$ SD	$\bar{X}$ SD	$\bar{X}$ SD	$\bar{X}$ SD
0	49	7.75 (.25)	7.38 (.29)	8.01 (.24)	6.53 (.28)
1	26	8.87 (.42)	6.94 (.34)	8.01 (.40)	6.61 (.32)
2	37	7.90 (.30)	7.19 (.31)	7.89 (.29)	6.44 (.30)
3	23	7.57 (.37)	6.47 (.42)	7.77 (.35)	6.91 (.40)
TOTAL	135	8.02 (.17)	6.99 (.17)	7.92 (.16)	6.62 (.16)

1
Treatment: F (dfb=1, dfe=126) = 18.08, p < .0001

DDD: F (dfb=3, dfe=126) = 1.78, p < .15

Treatment X DDD: F (dfb=3, dfe=126) = 1.94, p < .13

2
Treatment: F (dfb=1, dfe=126) = 32.03, p < .0001

DDD: F (dfb=3, dfe=126) = 0.11, p < .95

Treatment X DDD: F (dfb=3, dfe=126) = 0.35, p < .79

Table 3

I. Written Test

Item	M3s (Rxx = .18) Mean % Correct	Discriminative
1	.94	.26
2	.96	.25
3	.77	.25
4	.60	.45
5	.91	.38
6	.60	.36
7	.70	.37
8	.55	.30
9	.64	.55
10	.67	.30

II. Video Test

Item	M3s (Rxx = .41) Mean % Correct	Discriminative
1	.78	.62
2	.84	.29
3	.82	.52
4	.61	.64
5	.70	.52
6	.93	.05
7	.99	.02
8	.98	.21
9	.63	.48

Table 4

Student Evaluation of Computer-Videodisc Program (N=65)

SA = Strongly Agree
A = Agree
SlA = Slightly Agree
SlD = Slightly Disagree
D = Disagree
SD = Strongly Disagree

	SA	A	SlA	SlD	D	SD
Technical Qualities						
This computer-videodisc program was easy to use.	61.5%	33.8%	3.1%	0%	1.5%	0%
It was hard to read the text on the screens.	0%	0%	3.1%	10.8%	32.3%	53.8%
After the orientation, I needed more help in getting the program to work correctly.	3.1%	7.7%	4.6%	3.1%	16.9%	64.6%
Sometimes the program failed to work properly.	6.2%	30.8%	23.1%	1.5%	23.1%	15.4%
The program moved too slowly.	7.7%	29.2%	32.3%	10.8%	13.8%	6.2%
Educational Qualities						
The video segments showing children aided my learning.	64.6%	27.7%	3.1%	1.5%	1.5%	1.5%
Overall, the material was organized in a manner that helped me learn.	29.2%	58.5%	10.8%	1.5%	0%	0%
The text was easy to understand.	36.9%	58.5%	4.6%	0%	0%	0%
Overall, the material presented was too complex.	0%	0%	6.2%	10.8%	43.1%	40.0%

Table 4 (continued)

	SA	A	SlA	SlD	D	SD
The ability to review material aided my learning.	30.8%	50.8%	9.2%	4.6%	4.6%	0%
Completing this program improved my skills in assessing neuromotor problems of infants.	26.2%	60.0%	13.8%	0%	0%	0%
The program would have been just as effective without the test questions.	1.5%	6.2%	4.6%	15.4%	43.1%	29.2%

Suppose you were a student on the obstetrics rotation and wanted to learn how to manage difficult deliveries. Rank the following learning opportunities according to how well each would meet your goal:

	Most 4	3	2	Least 1
Experience	73.3%	16.7%	10.0%	0%
Computer Videodisc	15.0%	55.0%	16.7%	13.3%
Lecture	10.0%	16.7%	38.3%	35.0%
Readings	1.7%	11.7%	35.0%	51.7%

What was the longest period you were able to work on the videodisc before you needed a break?	$\bar{X}$	SD
	102.2	37.8 minutes

Would you recommend that this videodisc program continue to be avilable for junior medical students?	Yes
	63 (100%)

Appendix A: Examples from the 19-item Diagnostic Skill and Knowledge Test

A. Diagnostic Skill Subtest

(Student is shown a video segment of a 16-month-old displaying a developmental reflex.)

Question: What reflex is this child demonstrating?

a. Moro
b. Asymmetric tonic neck
c. Righting
d. Equilibrium

Is this reflex normally present at 16 months of age?

a. Yes
b. No
c. Variable

B. Knowledge Subtest

Question: A 24-month-old whose motor skills scatter from five to nine months would most likely have which diagnosis?

a. Treated congenital dislocation of the hips
b. Mental retardation
c. Cerebral palsy
d. Congenital heart disease